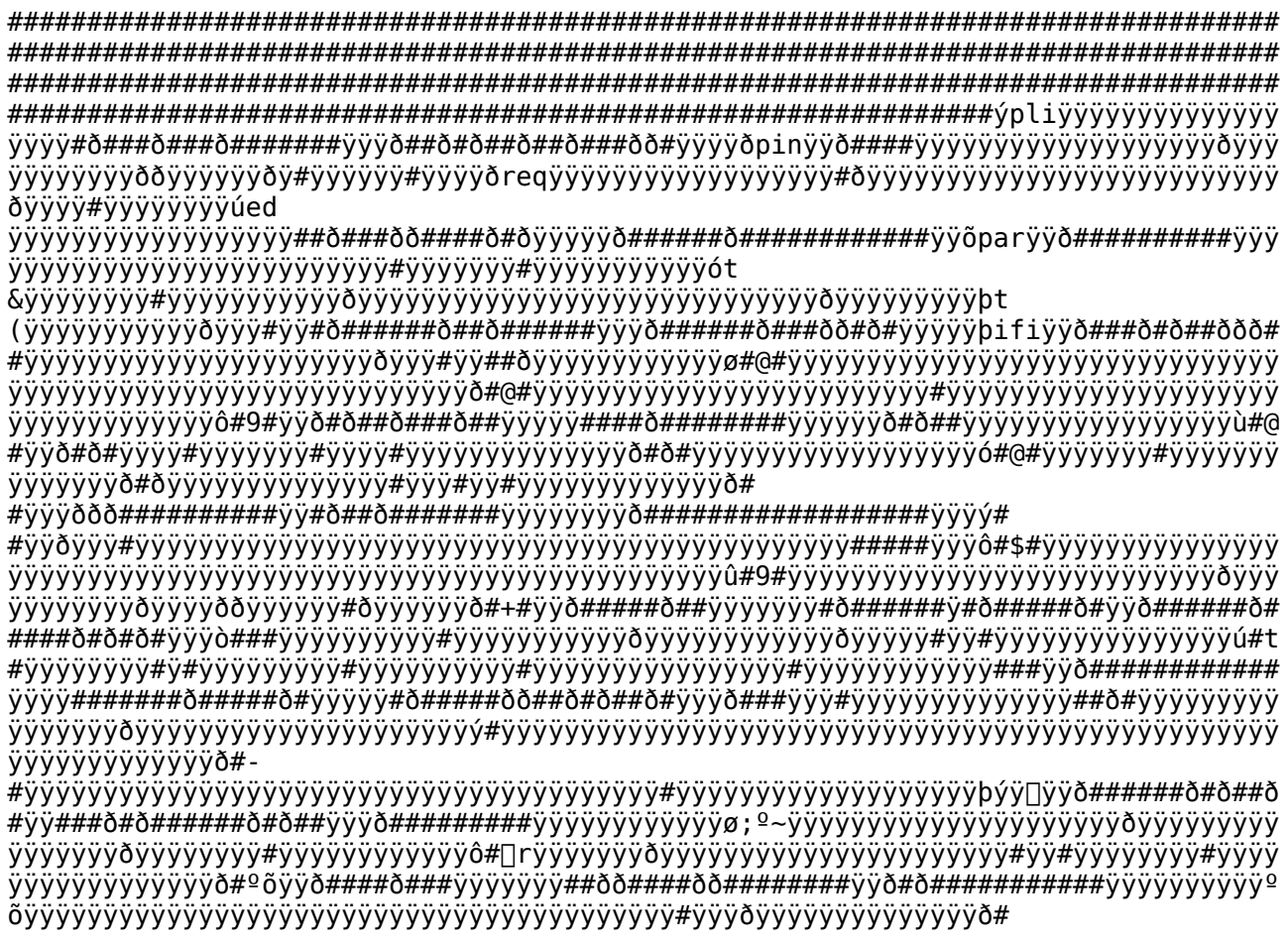

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Approach: utilize scanned probe microscopies to characterize structure and electronic properties on nanometer scale develop nanostructured HTSC materials with enhanced vortex pinning and critical current densities#

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#####3##□##□û#f#¨#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#########?###Accomplishments: nanostructured HTSC materials with enhanced vortex pinning and critical current densities shown MgO nanorods with required chemical reactivity and structural anisotropy synthesized nanorod-superconductor composite with oriented structure prepared and shown to have enhanced critical current density #

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B#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#2#######6###Impact & Transition: efforts to
exploit this S&T for wire development (American Superconductor)nanostructured
approach extends significantly power throughput and operating temperatures of
BSCCO HTSCs enables well-defined pattern definition in high-Tc superconductor
films required for fabrication of devices
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#########3##□##ºõÝúö#«üÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#2#######³###Technology Issues:· the critical current density impacts all HTSC application areas· power transmission; motors; magnets; communications· key issues are HTSC structure and defects#

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      Òùÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#2#######T###Nanostructure Control of High Temperature SuperconductorsLieber, Harvard University

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develop methods to probe nanostructure/electronic properties· prepare new 1-
dimensional (1D) nanostructures· exploit 1D nanostructures as defects in HTSCs·
demonstrate method for enhanced critical current density#
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õ}#füì#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#############Approach:Understand and control
the effects of mass and volume fluctuation on lattice thermal conductivity
Identify dopants for desired type (n or p) and optimize electrical conductivity
Fully characterize systems in terms of structure, electrical, and thermal
properties #

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Accomplishment: Discovery of over 14 new ternary compounds in the Skutterudite family Produced significant thermal conductivity reductions in skutterudite $CeFe_{4-x}Co_xSb_{12}$ shown to have ZT values of 1.4 at 600K

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ì#ÿÿ####ÿÿ#####ÿ□#ÿÿd#########d#2###########Impact: discovery of new structures expands the materials class and yields structure/property relationships verified that filling of skutterudite cavities does yield low conductivity verifies that ZT enhancement is possible and is not stuck at a value of 1

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